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MONTANA STATE DEPARTMENT OF HEALTH
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ENVIRONMENTAL SCIENCES

WATER POLLUTION CONTROL IN CASCADE COUNTY

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Introduction

Prior to 1955, Montana's water pollution control law protected only public health. It was with this provision that Great Falls, Belt and Cascade were requested in 1952 by the State Board of Health to provide primary treatment of their sanitary sewage discharges.

The 1955 State legislature enacted a law which also gave protection to other beneficial uses such as fishing and wildlife, recreation, industrial and agricultural water uses. The 1955 law set up a water pollution control council to establish rules and regulations and to guide the program administered by the State Department of Health. The seven-member council has representatives from agriculture, municipalities, inorganic and organic industries and the State Department of Health, Fish and Game and Water Resources.

One of the duties of the council was to classify the streams of the State according to their most beneficial uses and to establish water quality criteria for the streams. Following a stream survey in the Missouri River drainage during the summers of 1958 and 1959, the streams in the Missouri River drainage in Montana were classified and stream criteria were established in 1960. Montana was one of the first states in the nation to develop a stream classification means of water pollution control.

Congress, in 1965 enacted the Federal Water Quality Act which required that all states classify and establish water quality criteria for their interstate streams by July 1, 1967 and issued guidelines for this purpose. The only interstate stream in the Great Falls area is the Missouri River itself.

The Montana Water Pollution Control Council decided to revise the existing classifications and water quality criteria before submittal to the Federal government since ten years' experience had shown some areas where the existing standards could be improved. For example, it was felt that a higher dissolved oxygen content was desirable for a trout fishery. Following a public hearing in Helena during May 1967, revised classifications and water quality criteria were adopted for both interstate and intrastate waters.

The revised standards require a higher degree of stream quality than the original standards. Also, new minimum treatment requirements were

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established which require at least the equivalent of secondary treatment for sewage and industrial waste. The prior minimum requirement was primary treatment followed by adequate disinfection for domestic sewage with no specific minimum treatment requirement for industrial wastes.

The new minimum treatment requirements were adopted because the attitudes of the people have changed towards water pollution control. It has changed from the attitude of doing only what was necessary to maintain minimal water quality standards to one that now places primary emphasis on maintaining the best water quality practical.

The term BOD (biochemical oxygen demand) is used frequently throughout this report. BOD is a measure of decomposable organic material. The main purpose of secondary treatment is to convert organic material through biological treatment to an inorganic form which will not affect the stream. Organic material when discharged to a stream uses up oxygen which is necessary to support fish and other aquatic life, and this organic material is also partially responsible for excessive algal growths in a stream.

During the fall of 1970, a stream survey and waste discharge inventory was made in the Great Falls area to determine the present quality of surface water in the Great Falls area and the amount and composition of wastes discharged. This report compares existing water quality and present waste disposal practices with the State's water quality standards, provides recommendations for improvement of water quality and discusses some of the fringe area problems which are directly related to water pollution control.

Water Quality Standards

The following classifications have been adopted by the State Water Pollution Control Council for waters in Cascade County:

Missouri River and tributaries to Sun River	$B\text{-}D_1$
Sun River and tributaries to Muddy Creek near Vaughn	$B\text{-}D_1$
Muddy Creek drainage	E
Sun River from Muddy Creek to the Missouri River	$B\text{-}D_3$
Tributaries to the Sun River from Muddy Creek to the Missouri River	$B\text{-}D_1$
Missouri River from Sun River to Rainbow Dam	$B\text{-}D_2$
Missouri River and tributaries from Rainbow Dam to county line except the tributaries listed below:	$B\text{-}D_3$

Belt Creek and tributaries to and including Otter Creek except portion of O'Brien Creek as listed below:	$B\text{-}D_1$
Upper O'Brien Creek and tributaries to Neihart water supply intake	$A\text{-open-}D_1$
Belt Creek from Otter Creek to the Missouri River	$B\text{-}D_2$
Tributaries to Belt Creek from Otter Creek to Missouri River	$B\text{-}D_1$

Only one stream in Cascade County has an A-open-D1 classification. This is the section of O'Brien Creek and tributaries above the Neihart water supply intake. The town uses only simple disinfection for treatment of their water. In the A-open-D_1 classification, the water is classified for the use of drinking, culinary and food processing purposes suitable for use after simple disinfection and removal of naturally present impurities. Water quality is also maintained suitable for the use of these waters for bathing, swimming and recreation; growth and propagation of salmonoid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. The coliform bacterial limit for waters in this classification is 50 coliforms per 100 milliliters. Dissolved oxygen must be maintained above 7.0 milligrams per liter, and pH must be maintained between 6.5 and 8.5. No increase in turbidity is permitted. A maximum of 2° temperature increase is allowed between the temperature range of 32° to 67° F and from 67° F only a 0.5° maximum increase is permitted. Residues such as oils, floating solids, sludge deposits, and sediment must be kept out of the stream so they do not affect the uses of the stream. Chemical constituents listed in the 1962 Public Health Service Drinking Water Standards must be kept below the maximums established. However, an increase of 10 percent of that naturally present is permitted if it does not exceed the established limits. No matter is permitted in the water that would affect the aesthetics of the stream.

A substantial portion of the streams in Cascade County is classified as B-D1. This means that the waters must be maintained suitable for water supply for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of salmonoid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. This classification is generally applied to streams in the State where it is practical to maintain a salmonoid (trout) fishery. The coliform limit is 1,000 per 100 milliliter maximum when these coliforms are demonstrated to be the result of domestic sewage. A maximum turbidity increase of 5 Jackson Turbidity Units is permitted. This turbidity increase would not be noticeable in the typical stream in

Cascade County. The pH, temperature, residuals and sediment conditions would be essentially the same as in an A-open-D_1 water and wastes which affect the senses of sight, touch, smell or taste would not be permissible in the stream.

The B-D_2 classification is essentially the same as the B-D1 classification except it is generally applied to water where the propagation of salmonoid fishes is marginal due normally to temperature conditions on the stream or the type of substrate available in the stream bottom for propagation of fish. The mainstem of the Missouri River from the Sun River to Rainbow Dam has this classification. The temperature in the river is gradually increasing as it flows downstream during the summer and the type of substrate available for salmonoid fish spawning is extremely limited. The temperature affects dissolved oxygen concentration and as the temperature increases, saturation values of dissolved oxygen decrease; therefore, a 6 milligram per liter dissolved oxygen content is the minimum established which is one milligram per liter less than that for a B-D_1 stream. A higher turbidity increase above that naturally occurring is also permitted for a B-D_2 stream. This is 10 Jackson Turbidity Units.

A B-D_3 classification is applied to streams where the growth and propagation of salmonoid fishes does not normally exist usually due to additional temperature increases that occur naturally. At this point in the stream, we normally find non-salmonoid or warm-water fishes which are more tolerable to the lower dissolved oxygen concentration and higher temperatures. Also, they are less susceptible to other changes of river water conditions. A pH range of 6.5 to 9.5 is permitted. A temperature increase of 4° maximum is permitted when the river water temperature is 32° to 85° F, and above 85° F, a 0.5^{o} maximum increase is permitted. The other conditions to be maintained are essentially the same as a B-D1 water.

One drainage in Cascade County has an E classification, and this is the Muddy Creek drainage which is essentially irrigation return and drainage flow during periods of the year. These waters must be maintained only suitable for agricultural and industrial water supply usage and in a condition not offensive to the senses of sight and smell.

Along with the water quality criteria, policy statements were developed by the Water Pollution Control Council. Statements which are of particular interest to the Great Falls area are:

> "Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at that high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social de-development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to higher quality waters

will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised in order to discharge his responsibilities under the Federal Water Pollution Control Act, as amended." (This statement in essentially the same form was added to the water pollution control act by the 1971 legislature.)

"The water quality standards are subject to revision (following public hearings, and, in the case of interstate streams, concurrence of the Federal Water Pollution Control Administration) as technical data, surveillance programs, and technological advances make such revisions desirable. There are waters in the state on which little water quality data are presently available. Water quality criteria for these waters were established to protect existing and future water uses on the basis of the most representative information available." (The Montana water pollution control act (1971 revision) prevents lowering of classifications.)

"As used in the Water Quality Criteria, the phrases "natural," "naturally present," and "naturally occurring" are defined as conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Waters below existing dams will be considered natural." (This statement in essentially the same form was added to the water pollution control act by the 1971 legislature.)

"It is the intent of the criteria that the increase allowed (temperature for example) above natural conditions is the total allowable from all waste sources along the classified stream."

"Although the water quality criteria specify minimum dissolved oxygen concentrations, it shall be the policy of the Council to require the best practicable treatment or control of all oxygen-consuming wastes in order to maintain dissolved oxygen in the receiving waters at the highest possible level above the specified minimums."

"For treatment plant design purposes, stream flow dilution requirements shall be based on the minimum consecutive 7-day average flow which may be expected to occur on the average once in 10 years."

"Where sampling stations and points of mixing of discharges with receiving waters as mentioned in the water quality criteria are to be established on interstate waters, the concurrence of the Federal Water Pollution Control Administration will be solicited."

"Where common treatment is practicable, it is the policy of the Council to restrict the number of sewer outfalls to a minimum."

"Insufficient information is available for establishing fixed sediment criteria at this time. Until standards can be set, reasonable measures, as defined by the Water Pollution Control Council, must be taken to minimize sedimentation from man's activities."

Basically, the water quality criteria, stream classifications and policy statements are the material which make up the State's water quality standards. Along with the water quality standards, a compliance plan has been developed to upgrade the waters of the State.

Wastewater Disposal

Before 1961, wastewater treatment for all practical purposes was non-existent in Cascade County. The following is a summary of treatment progress made to date and the improvements that are expected in the next few years. Table I lists existing municipal and industrial waste sources and their estimated existing and projected waste loadings. Location of waste sources is shown on Figures 1 and 2.

Table I

Municipality or Industry	1970 Population	Estimated BOD Contribution Pounds per Day 1960	1972	1990 est.
Great Falls	60,091	17,000	11,000	3,000
Malmstrom AFB	10,000*	1,200	400	400
Belt	656	100	20	30
Cascade	714	100	20	30
Vaughn	300*	13	25	10
Simms	200*	0	0	0
Ft. Shaw	135*	0	0	0
Sun River	110*	0	0	0
Ulm	494*	0	0	0
Sandcoulee	290*	15	15	0

Municipality or Industry	1970 Population	Estimated BOD Contribution Pounds per Day 1960	1972	1990 est.
Tracy	190*	10	10	0
Stockett	490*	30	30	0
Neihart	109	15	15	0
Monarch	35*	0	0	0
Great Falls Breweries	-	1,000	-	-
Burlington Northern	-	15	-	0
Anconda Company	-	150	12	12
Ayrshire Dairy	-	60	14	14
Great Falls Meat Co.	-	1,000	184	0
Phillips Petroleum Co.	-	170	24	24
TOTALS		20,878	11,769	3,510

*Estimated

Great Falls Area

City of Great Falls (Population 60,091)

The City's present sewage treatment plant was placed into operation in 1961. This is a primary treatment plant which removes the solids which settle from the sewage as they pass through large open tanks. The solids are removed from the tanks by mechanical scrapers and pumped to digesters where the sludge is decomposed by anaerobic action. The digested solids are then dewatered on mechanical filters, and these solids are used as compost following further treatment. The sewage as it leaves the plant is chlorinated before being discharged to the Missouri River. The treatment facilities are well operated and maintained, and excellent records are kept. The plant records indicated a BOD reduction of 37 percent through the plant for 1970 which is good removal for a plant such as this.

The sewage treatment plant was designed for a maximum daily sewage flow of 11.8 million gallons per day. This flow is approached or exceeded during periods when heavy storm runoff occurs and during spring and early

summer when the river water levels are high and groundwater infiltrates into the sewer system. Three problems are present which prevent optimum functioning of the treatment plant at all times of the year:

1. Surface drainage from about 20 blocks of Great Falls are connected to the sanitary sewer system through storm inlets along Third and Sixth Streets. When heavy runoff occurs, some sewage is by-passed untreated to the Missouri River at the Sixth Street sewage pumping station.

2. The flow to the sewage pumping station located at the sewage treatment plant which serves a portion of the area west of the Missouri River is too large during periods of snow and storm runoff to be adequately handled by the existing pumps. This problem is due, in part, to the poor conditions of some of the older sewers which allows groundwater to enter the sewer. Some storm water from the fairgrounds is also discharged to the sanitary sewer system.

3. The chlorination facilities are inadequate to properly disinfect the sewage at all times.

The Sixth Street bypass problem should be corrected during 1974 with a construction project which is planned to separate the storm and sanitary sewers. Reconstruction of a portion of the westside sewer is planned for 1975 and separation of the fairgrounds storm water sewer connections is planned for construction soon, but an exact date has not yet been established. Improved chlorination facilities are planned with further expansion of the treatment plant.

In addition to these problems, the City has been placed on a compliance plan to provide secondary treatment of its sanitary sewage by the State Board of Health and Environmental Sciences. A compliance date of January 1, 1974 has been established for the City to complete the project. A preliminary engineering report was completed in 1970 by the Black & Veatch Consulting Engineers which outlined the proposed improvements needed to meet the secondary treatment requirements for a 20-year design period. A biological treatment plant which will produce a minimum of 90 percent removal of BOD at the design organic loading of 120,000 population equivalent and an average daily flow of 21 million gallons per day. This should produce a maximum discharge of BOD to the Missouri River of 3,000 pounds per day at design loadings compared to the 11,000 pounds per day which present exists and the 17,000 pounds per day which existed in 1960 before the existing treatment plant was constructed. The cost of providing secondary treatment is estimated at $13,100,000 by the City's consulting engineers. The first contract has been already awarded, and the last three contracts will be awarded as Federal grant funds become available.

The City sewerage and treatment system receives about the normal loadings expected from a city of its size. The main organic loadings other than the

residential areas are from a potato chip plant, dairies, flour mills, and a seed processing plant. The actual loading from these industries has not yet been determined, and with the high population equivalent of wastes indicated, these loading values should be determined at an early date. The Great Falls Breweries which discharged a BOD loading estimated at 1,000 pounds per day discontinued operation in 1968. For all practical purposes, all sources of domestic sewage and industrial wastes within the City limits are connected to the City sewerage system.

Residential Area Adjacent to Great Falls

The City has not permitted connection of areas outside of the City except for the Phillips Petroleum Company where a City sewer line traverses its property and sanitary sewage has been connected, the community of Black Eagle (estimated population 2,200), and the Great Falls International Airport. Black Eagle maintains its own sewerage system and contracts with the City for treatment of its sewage.

The City's policy of not permitting connection unless the area is within the City is similar to policies established by other cities in the State. Municipalities in the State have poor annexation authority and obtaining a satisfactory sewer system is one of the main incentives for an area to be annexed.

Wenzel and Company prepared a Master Plan for sewerage and drainage facilities for Great Falls in 1967. This report in addition to providing recommendations for improving the existing system, sets forth a plan for extension of sewerage service to the adjoining areas of Great Falls as these areas are developed. This report was updated in 1972 by Black & Veatch, Consulting Engineers. The plan recommends utilizing a single treatment facility at the present location. Of course, any plan such as this is practically useless unless development is planned and controlled by proper zoning. Money is also wasted by constructing improperly sized sewers when it is not known how an area will be developed. The Black & Veatch report used information from a land use plan prepared by Small, Cooley and Associates for the Great Falls City-County Planning Board in establishing population densities. Adequate planning has been accomplished, but zoning is needed to insure orderly construction of utilities.

Present sewage disposal in the adjoining areas is by septic tank and subsurface disposal with a few minor exceptions. An estimated 6,000 people are served by subsurface disposal in the Great Falls City-County planning area. Non-overflowing sewage lagoons are used at the Pearson Addition and Trailer Terrace Trailer Court. Sanitary sewage from these developments should be connected to the City system as sewers are extended to this area. The soil for subsurface disposal is considered poor in most locations near the City. The State has a subdivision law which relates to the provision of adequate water supply and sewage disposal for new subdivisions. The City-County Health Department issues permits for new or repaired individual sewage disposal systems. The soil at each development or residence must be examined to determine the adequacy of subsurface disposal and the disposal system designed accordingly. There are developed areas near the City that are in need of connection to the City sewerage

system. The area between the City and Malmstrom Air Force Base, the area along the Missouri River upstream of the City, and some commercial developments along the Northwest Bypass are in immediate need of connection to the City sewer. There are possibly small sources discharging to streams in the area, but these are corrected as they are found by the City-County Health Department.

Malmstrom Air Force Base

The Malmstrom Air Force Base recently completed their own secondary sewage treatment facilities. They constructed their own facilities as they could not come to terms with the City of Great Falls for provision of this service. The BOD of wastewater discharged should be less than 400 pounds per day.

Burlington Northern Railway Shops

Wastewater from this facility discharges to the Missouri River above the Central Avenue bridge. This was the source of a large amount of oils, particularly at times when oil tank cars were cleaned. The company was placed on a compliance plan by the State Board of Health and Environmental Sciences to provide improved oil removal facilities. In 1971, car washing was discontinued. Further investigation is needed to determine if there is still a need for improved facilities. Sampling results submitted by Burlington Northern indicate that conditions have substantially improved since discontinuing the car washing. Sanitary sewage from the yards is discharged to the City sewerage system. Little would be gained by discharging the other wastewater to the City sewerage system.

The Anaconda Company

The Anaconda Company Reduction Works located just east of Black Eagle completed a secondary sewage treatment plant (two-stage trickling filter) with chlorination facilities for the southwest area of their property in 1969. A sewage lagoon was constructed to serve the northeast area in 1970. Chlorination facilities were later added. The estimated BOD of the discharge is 12 pounds per day. They constructed their own facilities because of the difficult construction and long pumping line that is needed to connect to the City. If development occurs to the east of the plant, connection of sanitary sewage to the City systems should be considered.

The metal content of the industrial waste discharge has been of particular concern to the State Department of Health and Environmental Sciences. In 1968, a program was initiated by the Anaconda Company to return waste flows containing metals back to the process system. This program has consisted of separating cooling water and sanitary sewage from wastes containing metals, sealing leaks, and draining areas back to the process system where metal residuals could be carried away during storm runoff. This has substantially reduced metal losses to the Missouri River and work is continuing on this program to obtain further reductions. The biggest problem at the present time is potential losses that could occur if a break occurred in a pipeline containing a metal solution. This, of course,

happens only infrequently, but it does little good to provide good treatment 99 percent of the time only to have a large discharge at some later date undo the work that has previously been done. Two samples analyzed by the State Department of Health demonstrate this problem:

West Ditch (Results in milligrams per liter of total metal)

Date Sample Taken	Zinc	Copper	Lead	Cadmium	Iron	Arsenic
October 6-7, 1970	16.0	20.0	0.17	0.23	1.05	0.068
October 14-15, 1970	2.8	0.21	0.0	0.17	0.10	0.012*

*Reflects concentration already in river.)

The October 6-7, 1970 sample was taken during a time that a break in a pipeline occurred and some metal solution was lost to the river. The October 14-15, 1970 sample reflects the normal operation. Since the date of the October 6-7 pipeline break, better inspection has been provided by the Anaconda Company personnel and emergency retention facilities are being constructed by the company. A compliance date of January 1, 1973 has been established by the State Board of Health and Environmental Sciences to provide these facilities, and the major portion should be completed by that date. The Anaconda Company operates its own wastewater monitoring system which has been of great assistance to them in reducing metal losses.

At the estimated ten-year flow of 2,500 cubic feet per second in the Missouri River at Great Falls, the discharge from the Anaconda Company after mixing with the river and using the October 14-15 values would cause an increase of 0.03 milligrams per liter of zinc; 0.002 milligrams per liter of copper; 0.002 milligrams per liter of cadmium; and 0.001 milligrams per liter of iron. Under normal operations, the increase of metals in the Missouri River from the Anaconda Company operation should be of minimal significance to the river. With the shut down of the zinc facilities, metals should be substantially reduced from those shown on October 14-15, 1970. Results that occurred on October 6-7, 1970 could possibly affect the fishery in the river, but would not damage a downstream water supply. There is some cooling water discharged by the company, but the amount is not great enough to measureably alter the temperature of the Missouri River a short distance from the outfall. Connection of industrial wastewater (about 10 million gallons per day) to the City sewerage system would accomplish nothing and only hydraulically overload the facilities.

Ayrshire Dairy

Wastewater from this dairy operation passes through a natural drainage which has a dam across the lower end to form a pond. The overflow discharges to an old channel of the Missouri River. Sampling of the pond overflow

in 1968 indicated that a substantial reduction of BOD was accomplished in the pond. Since this date, improvements have been made to the ponding system. An estimated 14 pounds of BOD is discharged each day from the ponding system. Further investigation is needed to determine if additional improvements are needed.

Great Falls Meat Company

A lagoon system was constructed in 1964 for the plant wastewater. Sampling on October 6-7, 1970 indicated an 82 percent removal of BOD with a BOD of 184 pounds per day discharged to the river. The overflow from the lagoon system flows through a pipe from the lagoon to the railroad tracks and from the railroad tracks, it flows down a coulee to the Missouri River. Recommendations for further reducing the BOD and piping the lagoon overflow directly to the river have been made to the company, and a compliance date of July 1, 1973 has been established for accomplishing this. The company, during the past summer and fall, utilized the wastewater for irrigation with essentially no discharge to the river. Construction of a new meat packing plant is planned for 1973, and waste treatment improvements are also planned. When sewers are extended to this area from the City, connection of wastewater from this facility to the City sewerage system should be considered.

Montana Power Generating Stations

Sanitary sewage from company housing and the four generating stations located below Great Falls was discharged with little treatment until 1970. Secondary treatment and chlorination has been provided at all stations where there is a discharge of sanitary sewage. It is not feasible to connect these sewers to the City sewerage system. Housing near Morony Dam formerly owned by Montana Power Company and now privately owned needs new treatment facilities, and this is being planned.

Phillips Petroleum Company

Sanitary sewage is discharged to the City sewerage system. The industrial wastes from this refinery were formerly treated through an oil separator and small ponds before discharge to the Missouri River. This proved to be inadequate. A new oil separator was constructed in 1967; an air flotation unit to further reduce oils was constructed in 1969; and an aerated lagoon and polishing lagoon were placed into operation in 1970. On October 6-7, 1970, oils were reduced from 458 milligrams per liter to 5.6 milligrams per liter; phenols from 14.8 milligrams per liter to 0.00; and BOD from 332 milligrams per liter to 7.0 milligrams per liter. These results indicate excellent reduction of these compounds in the wastewater which could be detrimental to the river. Recent sampling by the company has indicated much higher oil results. Improvements are being planned to reduce oils.

Fish Hatchery Wastewater

The State Fish and Game Department operates a fish hatchery at Giant Springs. No sampling has been performed on this wastewater. The Federal Water Quality Administration (now Environmental Protection Agency) recently released a report, "An Evaluation of Salmonoid Hatchery Wastes." In their summary they stated, "Waste concentrations of hatchery effluents are small; however, total pounds discharged per day can be of significant magnitude. Hatchery discharges increase chemical oxygen demand (COD), total phosphorous, orthophosphate, total KJeldahl nitrogen and ammonia nitrogen by 2.0, 0.36, 0.15, 0.20 and 0.058 pounds per 100 pounds fish per day, respectively." Using their estimate of a BOD to COD ratio of 0.67, the BOD of the fish hatchery wastewater discharged to the Missouri River is estimated at a maximum of 335 pounds per day.

Cattle Feedlots

There are at least three cattle feeding operations located along the Sun River within 4.5 miles of Great Falls. Robinson Brothers Feedlot is located three-fourths mile from the City limits. Star Dairy is one mile from the City, and the McIver Ranch Company is two and three-fourths miles from the City. The pollution potential of these operations cannot be evaluated until a study is conducted of each site.

Because the Robinson Brothers Feedlot and the Star Dairy are located close to the City, one of their greatest problems is creation of nuisance odors. Comments made by the owners of the two businesses indicate that several special precautions are taken to minimize odor productions. The McIver Ranch Company is so located that odor problems are not as great a concern as drainage and runoff.

Several other cattle feeding operations are located in Cascade County. These will be discussed at a later section of this report.

Remainder of Cascade County

Using 1970 census data, about 9,000 people reside in the remainder of Cascade County. Through a grant from the Farmer's Home Administration, Small, Cooley and Associates prepared a comprehensive plan for sewer and water systems in Cascade County for the City-County Planning Board in 1969. These communities presently have sewerage systems and systems were recommended for nine additional communities. The three communities having sewerage systems have a total population of about 1,700 people. About 2,300 people reside in the other nine communities. An estimated 3,000 people live on farms in the area. The above reflects the sparse population in Cascade County outside of the Great Falls urban area. The following summarizes existing waste disposal practices and problems:

Town of Belt (Population 656)

The town completed its sewage lagoon system in 1964. The lagoon system is designed for a population of 680. Belt experienced a decrease of

population of 13.3 percent in the past 10 years. It seems reasonable to assume that the present system will be adequate for several years. The estimated BOD discharged is 20 pounds per day.

Town of Cascade (Population 714)

The town completed its sewage lagoon system in 1961 on an island in the Missouri River. The system is designed for 800 people. The estimated BOD of the discharge is 20 pounds per day. Cascade gained 18.2 percent in population during the past 10 years. Substantial growth in population will probably occur at Cascade. It is estimated that the existing lagoon system will be adequate in size for at least another 10 years.

Community of Vaughn (Population estimated to be 300)

The community of Vaughn has two sewerage systems, both of which are inadequate. The original townsite was set up as a Rural Improvement District under jurisdiction of the Board of County Commissioners and serves about 200 people. Treatment is provided in an Imhoff Tank (primary treatment). The sewer system needs to be extended to serve other homes not presently connected, and secondary treatment needs to be provided. Subsurface disposal has proven to work very poorly in Vaughn. An engineering report was prepared in 1968 by Turnbull and Plummer, Consulting Engineers, and it recommended expansion of the sewerage system and a lagoon system for treatment. The report considered a lagoon location which would serve the expected areas of development. A Federal grant offer was made in 1969, but was later withdrawn due to lack of action on the project.

The sewer system and lagoon which was constructed for Big Sky Vista, a private subdivision development has experienced trouble with the sewerage system and lift station. A study was completed by Turnbull & Plummer to determine the improvements needed and the feasibility of connecting to the proposed Vaughn townsite facilities. The sewerage facility serves an estimated 70 people. To date, the Big Sky Vista lagoon system has not had an overflow. A sewer district was established in 1972 to serve the townsite and Big Sky Vista and construction of a common treatment system is planned for 1973. Further growth is expected in the area.

Community of Simms (Population estimated to be 200)

A preliminary report was prepared by Ed Henen, Consulting Engineer, in 1962 for a community sewerage system. Present disposal is by septic tanks and subsurface disposal which do not function properly. The sewerage project has been inactive since completion of the engineering report. The population of Simms is expected to remain relatively the same.

Fort Shaw (Population estimated to be 135)

A sewerage system was recommended in the Small, Cooley and Associates report to replace the individual subsurface disposal systems which do not

function properly. The recent completion of a public water system may increase the subsurface disposal problems as more water will probably be used by each residence. With a good water system, it is also probable that some growth in population will occur.

Sun River (Population estimated to be 110)

A sewerage system was recommended in the Small, Cooley and Associates report to replace the individual subsurface disposal system which do not function properly. It is doubtful that population growth will be experienced in the community without public water and sewerage systems.

Ulm (Population estimated to be 494)

Because of its close location to Great Falls and interstate highway connection, a population growth can be expected. A public sewerage system is needed to accommodate this growth and to replace existing subsurface disposal systems. This recommendation was made by Small, Cooley and Associates. A preliminary engineering report should be made as soon as possible to determine costs for such a system.

Sandcoulee, Tracy and Stockett (Population estimated to be 290, 190 and 490

The Small, Cooley and Associates report recommended public sewerage systems for the two communities. A single system serving both Tracy and Sandcoulee was recommended. Present disposal is mainly by septic tank and subsurface disposal with some individual sewers reaching drainages in the area. Preliminary engineering is presently being completed for a sewerage and treatment system at Stockett. The creek waters in this area are extremely degraded from acid mine drainage from abandoned coal mines (this aspect is considered further in a later section of this report). It would appear improbable that growth will be experienced in these communities unless public sewerage systems and elimination of acid mine drainages are provided.

Town of Neihart (Population 109) and Monarch (Population estimated to be 35)

Both communities are located in areas where growth can be expected due to recreational activities. At one time a combined sewer system to serve both communities and the area inbetween appeared to be feasible. However, the area between the two communities is practically all Forest Service land and with recent Federal policy, little utilization of this land can be expected for private residential development. In order for either Monarch or Neihart to grow in population, public sewerage systems are needed. A high groundwater table in both areas prevents subsurface disposal systems from working properly. The area also has potential from the mining standpoint. A preliminary engineering report to determine estimated costs is particularly needed at Neihart.

Acid Mine Drainage

Probably the most serious form of existing pollution in the county is the acid mine drainage which severely degrades Sand Coulee Creek and its tributaries, Galena Creek, Dry Fork of Belt Creek and Belt Creek. George M. McArthur prepared a report, "Acid Mine Waste Pollution Abatement, Sand Coulee Creek, Montana" as a thesis while a graduate student at Montana State University in 1970. Financial support for the study was provided by the Montana State Board of Health and Environmental Sciences and Montana State University with other assistance provided by the Montana College of Mineral Science and Technology. The summary and conclusions of this report state in part:

> "The coal mines in the Sand Coulee Creek area are abandoned and are scattered over a 24-square-mile area. About 41 of these mines periodically contribute to the pollution load, with 9 of them contributing continuously. On September 6, 1969, Sand Coulee Creek, with a flow of 1,500 gallons per minute, received approximately 6,630 pounds per day of iron and 26,670 pounds of acidity (as $CaCO_3$)."

Mr. McArthur estimated the capital and operating cost of treatment of these wastes at $612 per day which did not include the cost of collecting lines and routing to the central treatment plant. Recommendations were made which included a partial treatment and mine flooding program which would improve the stream quality at a much lower cost but would not totally eliminate the degradation of the stream. It was also recommended that a study be made to establish the value to potential users (social and economic) of improving the quality of water in Sand Coulee Creek. The possibility of providing flooding of some of the mines through the proposed watershed flood control project was mentioned in the report. About 25 miles of stream are presently severely degraded.

Acid mine drainage also occurs immediately outside of Cascade County in Judith Basin County which affects Galena Creek and Dry Fork of Belt Creek in Cascade County. About 12 miles of stream are affected by the drainage from abandoned silver-lead mines. A report, "Acid Mine Drainage in the Hughesville, Montana Area" was prepared in 1970 by the State Department of Health. This report in part outlined a possible solution to improve the streams. The State Department of Natural Resources and Conservation is presently trying to obtain a Federal grant from EPA for a feasibility study for correcting this problem. Costs of the study are estimated at $50,000. Hopefully, and this requires the cooperation of many people, a project will be constructed and operated to treat the acid mine drainage in the not too distant future.

Acid mine drainage also occurs near the Town of Belt. The extent of the problem is not known at this time and field work is needed and is planned for 1973.

Cattle Feedlots

The main feedlot area in Cascade County is along the Sun River near Vaughn. Two feedlots were constructed northwest of Vaughn in 1970. Both feedlots

drain to ponds, and it is planned by the operators to use this drainage water for irrigation. Several feedlots are located between Vaughn and Great Falls near the Sun River. The actual effects of these feedlots on the Sun River is not known at this time. The State Board of Health and Environmental Sciences adopted a waste discharge permit regulation for feedlots during 1972. All new or expanding feedlots with the potential for water or air pollution are now required to have a waste discharge permit and existing feedlots will need waste discharge permits by May 1974. Additional feedlots will probably be constructed in Cascade County in the future, and this probably is the greatest potential for future pollution from any industry in Cascade County. However, with proper location, a small investment is needed for treatment and disposal facilities. With the new regulation, adequate control measures will be required to prevent pollution.

Farming

The effects of farming practices on water quality in the county have only been determined in one area. This is the Greenfields Bench irrigation project which returns water to Muddy Creek and then to the Sun River near Vaughn. Extensive erosion has occurred in the lower end of Muddy Creek due to excessive return flow from this project. Immediate action is needed to prevent further erosion by the creek and subsequent degradation of Sun River water quality by turbidity and sediment. A report, "Sun River Survey" was prepared by the State Department of Health following field work during 1970.

Gravel Washing Wastewaters

Three companies obtain gravel near the Sun River west of Vaughn. An inspection of Big Sky Sand and Gravel, Lewis Construction Sand and Gravel, and Northern Sand and Gravel was conducted to evaluate the adequacy of the facilities used at each operation to handle the silt ladened waste wash water. Satisfactory treatment facilities were provided at Lewis Construction Sand and Gravel and Northern Sand and Gravel but the wastewater disposal practices at Big Sky Sand and Gravel were marginal. Spent wash water from the Big Sky Gravel washing plant is diverted into a long grit removal trench in which most of the silt is settled out. Overflow from the grit removal trench contains most of the silt and is disposed of in a section of old river channel. If the river flows through this section of old river channel during high water, a great deal of silt will be picked up. The Big Sky plant should be visited during high water to determine whether or not improvements of the wastewater treatment system are necessary.

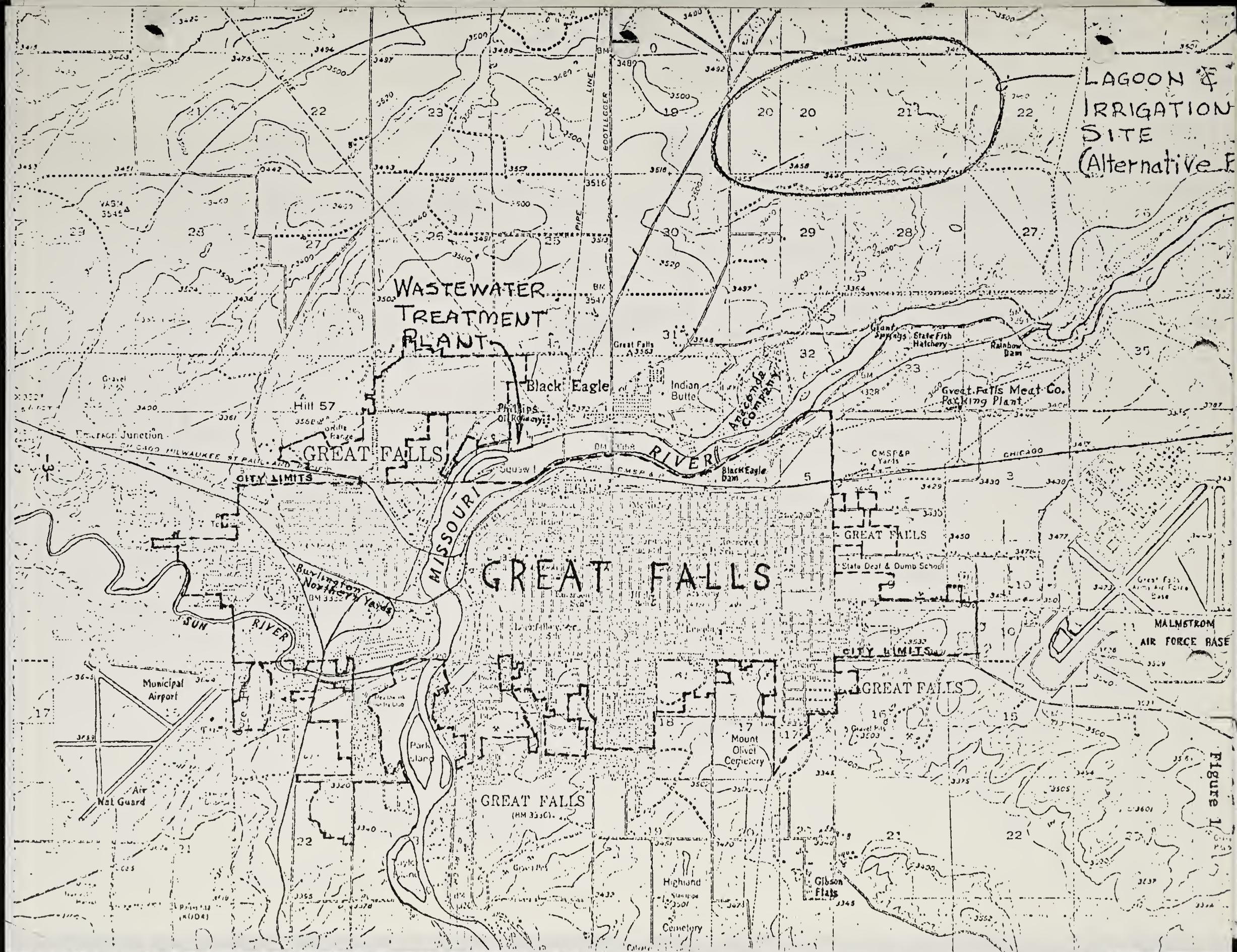
LAGOON & IRRIGATION SITE (Alternative F
WASTEWATER TREATMENT PLANT
Black Eagle
Indian Butte
Anaconda Company
Great Falls Meat Co. Packing Plant
Rainbow Dam
State Fish Hatchery
Hill 57
Phillips Oil Refinery
GREAT FALLS
CITY LIMITS
MISSOURI RIVER
Black Eagle Dam
CMSP&P Yards
CHICAGO
GREAT FALLS
State Deaf & Dumb School
Burlington Northern Yards
SUN RIVER
MALMSTROM AIR FORCE BASE
Municipal Airport
Air Nat Guard
Park Island
Mount Olivet Cemetery
GREAT FALLS
Highland Cemetery
Gibson Flats
Emerson Junction
Great Falls Army Air Force Base

Figure 1

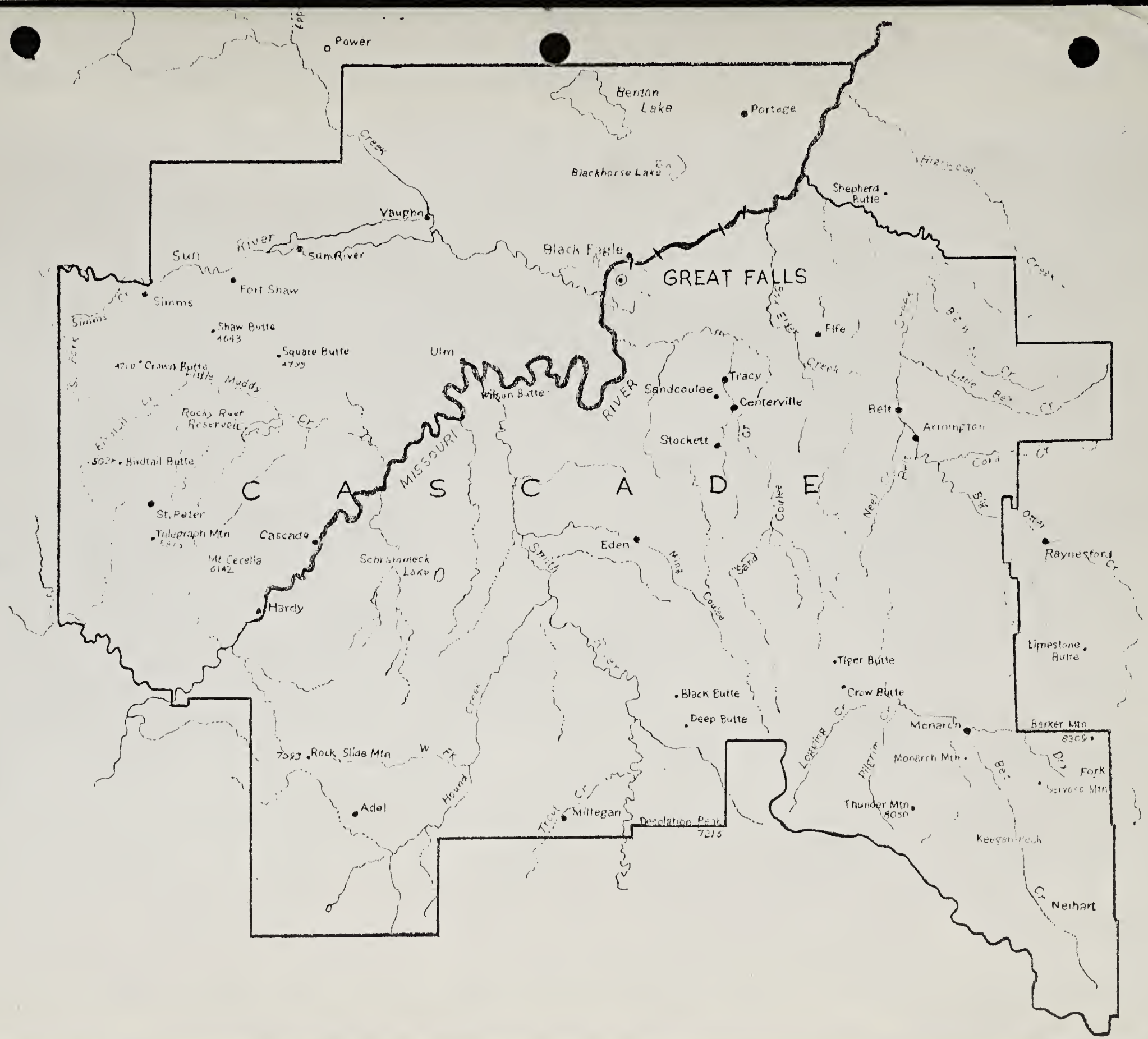
Power
Benton Lake
Portage
Blackhorse Lake
Shepherd Butte
Vaughn
Sun River
Sun River
Black Eagle
GREAT FALLS
Fort Shaw
Simms
Shaw Butte
4643
Square Butte
Ulm
Crown Butte
Little Muddy
Wilson Butte
Rocky Reef Reservoir
Birdtail Butte
MISSOURI
RIVER
Sandcoulee
Tracy
Centerville
Stockett
Fife
Belt
Armington
C A S C A D E
St. Peter
Telegraph Mtn
Cascade
Mt Cecelia
6142
Schrammeck Lake
Hardy
Eden
Raynesford
Limestone Butte
Tiger Butte
Crow Butte
Black Butte
Deep Butte
Monarch
Barker Mtn
8309
Monarch Mtn
Dry Fork
Servoss Mtn
Thunder Mtn
8050
Keegan Peak
Neihart
Rock Slide Mtn
Adel
Millegan
Desolation Peak
7215

FIGURE 2